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A DIVISION OF
~~FLIGHTEX FABRICS, INC.~~
[redacted]
EVERETT, MASS.

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REPORT NO. 5-60-50G-111

MONTHLY PROGRESS REPORT

ENGINEERING PROGRAM FOR
THE PILOT PRODUCTION OF A
LIGHTWEIGHT ANTITANK WEAPON

FOR THE PERIOD
MONTH OF MAY 1960

CONTRACT NO. RD-142

ORDNANCE PROJECT NO.

DEPT. OF ARMY PROJECT NO.

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HESSE - EASTERN DIVISION

FLIGHTEX FABRICS, INC.

FFCGRESS REPORT #1

ENGINEERING PROGRAM FOR THE PILOT PRODUCTION OF A LIGHTWEIGHT ANTITANK ROCKET

MAY 1960

CONTRACT NO. RD-142

PREPARED BY: Thomas H. Forman
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Project Engineer

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Charles B. Weeks
General Manager and
Technical Director

SUBMITTED BY: HESSE-EASTERN DIVISION
FLIGHTEX FABRICS, INC.
EVERETT, MASSACHUSETTS

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WORK DONE DURING THE MONTH OF MAY

SYSTEM EVALUATION PROGRAM

Propellant evaluation tests were completed, and the propellant lot was found to be acceptable. All explosives are now at hand to assemble the pilot lot. A test procedure for checking the performance of the boosters and detonators has been agreed upon. The necessary parts are being manufactured at the present time, and it is expected that the train functioning tests will be conducted in June.

Further work was done to control the trigger pull and to assure reliability under all temperature extremes. One way to accomplish this task consists in using a stab type primer. A firing test with this type of primer was conducted and has shown that the adoption of this item is not advisable. A set of conditions which will give reliable functioning under all temperature conditions has been established, using the percussion type primer. This will result in rather heavy trigger pull conditions at the cold temperature extreme. However, it is felt that the extremes of cold under which this igniter system has been tested are very unlikely to be encountered in the field (-40°F).

Components have started to arrive, and some subassemblies have been completed. Some delay in obtaining fuze parts is being experienced. It is not felt that this will cause serious delay to the over-all program.

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The steel for the penetration tests has been delivered to the J-2 Range. Angle iron holders are being designed to hold the stacks together for the testing.

PROPELLANT EVALUATION

The final shipment of propellant was evaluated by conducting a static test on 6 May. The curves obtained from the random sample were identical to previous curves. The propellant was therefore accepted as being satisfactory. As soon as pin plates become available, the whole quantity of charge assemblies which is required to finish the pilot run will be assembled.

The curves obtained with the various shipments can be superimposed without showing any appreciable variations.

The writer had occasion to visit Radford Arsenal and was conducted to the areas where this propellant has been manufactured. The tooling was found to be in fair condition. However, variations in propellant composition can never be guaranteed beforehand. In the event of larger requirements, it would be highly advisable to make new extrusion dies so that the present method of machining the propellant stick can be eliminated. The arsenal was visited in order to witness testing on another project. No discussion of the present contract took place.

TRAIN FUNCTIONING

A fixture for testing the train functioning of the stab detonator and the RDX booster versus the same detonator and the tetryl booster has been

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designed and is now being manufactured in sufficient quantities to run a series of 50 tests of each type of booster.

Drawing No. C-8633 (Appendix) shows this fixture. The detonator is being initiated by a firing pin which, by its weight and the distance through which it has to drop before making contact, closely simulates the firing pin in the fuze when operated by the firing pin spring only. This condition arises only under extremely light graze conditions. The momentum of the firing pin at the time of target impact has to be added to the force created by the spring under most fuze operating conditions and most certainly when the head of the round strikes a solid target.

The arrangement of the detonator and booster is identical to the assembly of these units in the round. The maximum figure for air gap between the detonator and the booster has been used. The same steel washer between the two explosive components is being used. The booster is centered by means of a wooden bushing.

The part of this fixture which holds the explosive elements in position is screwed to a 1/4" steel plate. The shape, size, and edge condition of the hole will be evaluated in determining detonator and booster performance.

RE. Report

The 1/4" size for the steel target plate was indicated by the Contracting Authority. Fifty RDX boosters and fifty tetryl boosters will be fired in order to evaluate the performance of the RDX booster and to find out whether reliable train functioning can be expected. It is planned to

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conduct a test of ten shots at first in order to find out whether any components of the fixture have to be modified in some way to facilitate testing or for any other reason.

A letter was written to Lorne in which the operation of the fixture was described. The thickness of the plate to be used was determined in the subsequent discussion.

FUNCTIONING OF IGNITER ASSEMBLY

In order to determine whether the igniter set-up as determined during April would function reliably at the hot temperature, a test at a temperature of 120°F was conducted on 6 May. Ten rounds were fired using the new assembly with parts selected in a manner which would produce the minimum of travel of the primer firing pin. The test was conducted with steel heavy wall motor bodies, but the remainder of the system was the final design.

The result of the test was negative. Of ten hot rounds fired, two failed to operate. It was found that the primer in both cases had not been struck with sufficient force to initiate the explosive coating on the anvil.

This problem received further study, and the chart shown on Drawing B-8658 was compiled as a result. Study of this chart will show the difficulty encountered when trying to create a low value for the trigger pull at all extremes and to still obtain reliable functioning. In order to further explain the chart, each column of the chart will be discussed.

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Column A shows the travel imparted to the firing pin by the actuating lever when this lever is moved from a dead vertical position to the point when it no longer keeps in contact with the firing pin and allows the pin to be driven forward. The left row of figures (amb.) shows the travel as obtained when the assembly is at a temperature of between 60° and 80°F. The middle row of figures shows the travel of the identical assembly when cooled to a temperature of -40°F, and the left row of figures shows the travel when the same assembly is heated to a temperature of 130°F. As can be seen, the total variation is .050".

In order to determine the travel from a vertical position of the actuating lever, the assembly is placed in a special fixture which holds the lever in the proper position. It has to be remembered, however, that once the travel from vertical has been determined, the actual travel when firing the round may vary somewhat from this value because of tolerance accumulations. However, some starting point from which easy assembly can be measured has to be found. The lever in the round assembly will merely have to move through the dead center position, or it will start its motion beyond this position. In either case, a measurement taken from a dead center position will still be valid.

Column B shows the compressed spring length resulting from the travel. The values are given at hot and cold temperatures only.

Column C shows the prestress of the spring, i.e., the amount by which the spring is being prestressed in the assembly before rearward motion of the actuating lever takes place.

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Column D shows the final compressed spring length, i.e., the spring length at the point where the actuating lever disengages the firing pin. This is determined by Column A and Column C.

Column D shows the total spring deflection at both extremes of temperature. This figure is somewhat theoretical in some cases, since the maximum deflection the spring can take is .310". In the case of values greater than this, the igniter parts have to be deformed by the additional amount. This is the factor which causes the heavy trigger pull values under cold conditions. It also has to be borne in mind that the parts of the igniter which take the deformation are less pliable under cold than under ambient and hot conditions.

Column F gives the length of the spacer which is inserted into the assembly in place of the firing spring in order to locate the end cap so as to obtain the desired values.

Drawing B-8658 shows values which were picked for the final design. Extensive static testing with both hot and cold igniter assemblies has been carried out, and 100% functioning was obtained. As can be seen by studying the chart, a combination which gives a very heavy trigger pull at the cold end will give a very acceptable figure at ambient or hot.

The combination as shown on Drawing B-8658 will produce acceptable results. The improved trigger linkage arrangement with the larger travel of the swivel sleeve (the member which operates the actuating lever when the trigger is being pulled) and with the more favorable angle of attack on the

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part of the trigger itself will more than overmatch the travel required by the actuating lever.

STAB TYPE PRIMER

After reviewing the above, it was felt that a strong reduction in the force required by the primer would be highly desirable. It is being realized that any such improvement would almost certainly wind up as a suggestion at the end of the final report, since no unnecessary changes will be incorporated into the pilot production lot.

The M45 stab type primer was tried out in a firing test conducted on 26 May. The end of the existing firing pin was changed to produce a point identical in angle to the point on the firing pin on the present fuze. The primer was held in an adapter, which took the place of the cartridge used at present.

The result of ten rounds fired was negative. Seven rounds failed to ignite the propellant at the cold temperature. This was caused by the fact that the output of this particular primer is far too strong and caused rupture of the igniter body in the area behind the primer. This opened up the throat end of the motor body before ignition of the propellant had been established.

The force requirement of the stab type M45 primer is a minimum of 8 in-oz as opposed to 20 in-oz for the percussion primer. The force requirements are correspondingly lower, and there does not exist any problem in encountering excess trigger pull at cold temperature.

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The possibility of using a stab type primer still exists. However, such a primer would have to be made up specially for the purpose, with a minimum amount of explosives and possibly containing the black powder within the primer can. This in turn would facilitate assembly very greatly. As stated before, such a development is out of place for the present project.

COMPONENTS FOR PILOT PRODUCTION LOT

Components for the pilot production lot are starting to be delivered. Some difficulties with parts which had to be rejected have been encountered. This was particularly the case with the springs for the fuze, all of which had to be rejected. Delivery of fuze components is also somewhat slower than expected. Some minor subassemblies have been completed for the total quantity.

The launcher components have been sent to us from Eastern Tool & Mfg. Co. in sample batches. Some changes had to be made in their tooling in order to make the parts conform to the print. Some minor difficulties have also been experienced with the exterior finish for the launcher metal parts. A visit to Eastern Tool has had the effect of eliminating all the questions, and the parts as received now are of very good quality.

A partial shipment of launcher tubes has been received and hydrotested. Some failures of tubes at the 900 psi pressure level (level of hydrotest) have been recorded. The manufacturer has stopped production in order to find out why tubes which withstand his hydrotest fail under the test imposed on them at Hesse-Eastern.

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It is strongly suspected that the testing done at the manufacturer's plant is causing the rejects, since they test at a higher pressure level than recommended.

Evaluating our inspection results, it was found that most rejects occurred in the first box of tubes. The vendor has stated that tubes tested to 1100 psi were all placed in the same box. The problem is being further investigated. However, the tubes as obtained to date appear to be as good or better than the tubes used in the R&D program.

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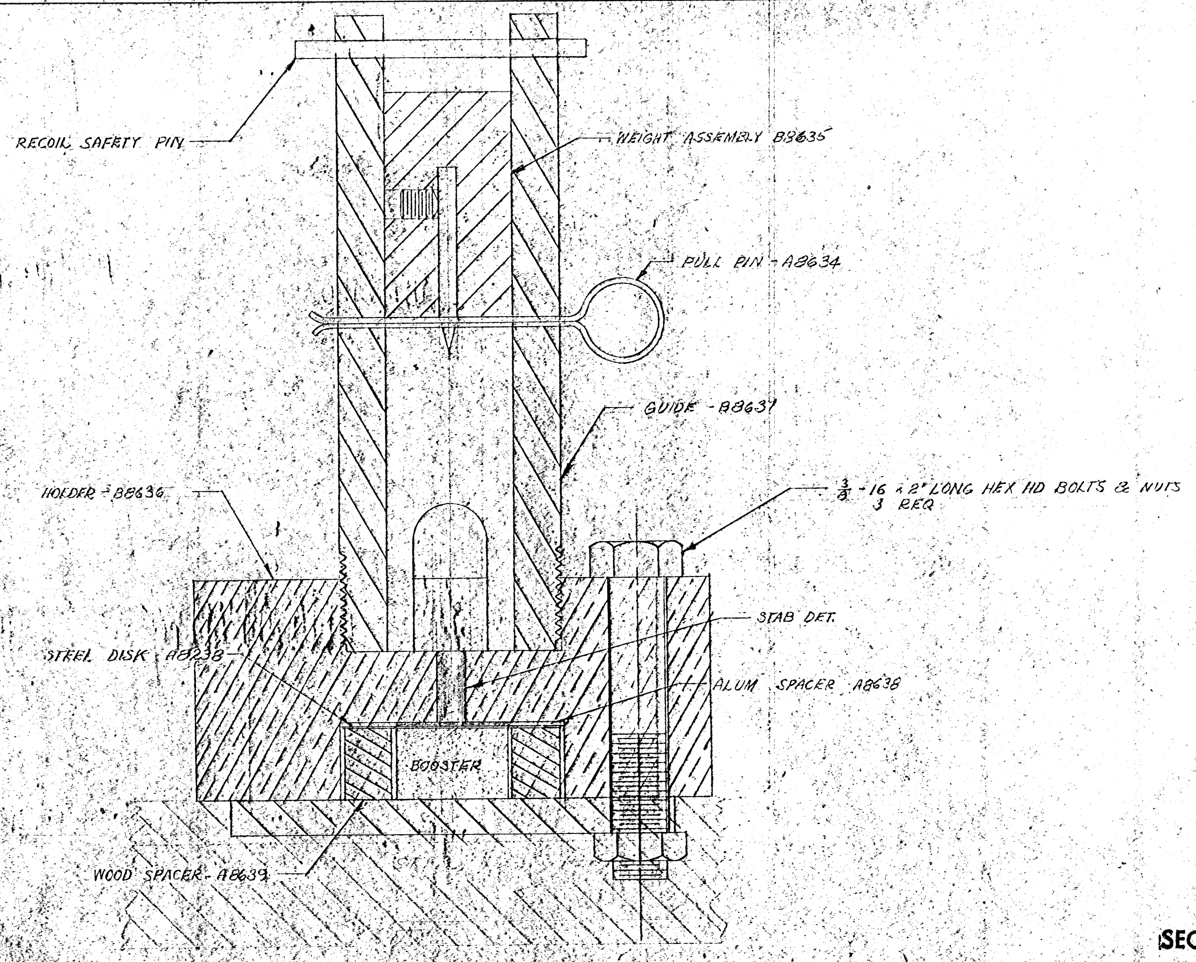

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REVISIONS	DO NOT SCALE DRAWING	ALL DIMENSIONS APPLY AFTER PLATING	125 FINISH ALL OVER EXCEPT WHERE NOTED	BREAK ALL SHARP CORNERS .005—.010	STANDARD TOLERANCES DECIMAL ±.005 FRACTIONAL ±1/64 ANGULAR ±1° ALL DIA. ON SAME ℄ TO BE CONCENTRIC WITHIN ... T.I.R. UNLESS OTHERWISE NOTED

HESSE—EASTERN DIVISION OF FLIGHTEX FABRICS, INC. CAMBRIDGE 38, MASS.		BY	JG 5/12/60
		CH'K'D	T.F. 5/13/60
BOOSTER TEST FIXTURE FOR DETONATOR - BOOSTER TRAIN FUNCTION TEST		ENG'R	T.F. 5/13/60
PROJ. 506-3	ASSY DWG —	APP'D	CBW 5/13/60
SCALE 2 x F.	REF DWG —	C 8633	REV. 0
MAT'L. —			

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MAX "E" = .310 W/O PARTS DEFORM.

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"A" TRAVEL			"B" COMPRESSED SPRING LENGTH (1.010 – "A")		"C" PRESTRESS OF SPRING	"D" FINAL COMPRESSED SPRING LENGTH ("B" – "C")		"E" TOTAL DEFLECTION OF SPRING (1.010 – "D")		F LENGTH OF SPACER (1.010 – "C")	
B.	COLD	HOT	COLD	HOT		COLD	HOT	COLD	HOT		
15	.340	.290	.670	.720							
00	.325	.275	.685	.735							
	.315	.265	.695	.745	.035	.660	.710	.350	.300	.975	
	.305	.255	.705	.755	.035	.670	* .720	.340	* .290	.975	
	.295	.245	.715	.765	.055	.660	.710	.350	.300	.955	
	.285	.235	.725	.775	.055	.670	.720	.340	.290	.955	
0	.275	.225	.735	.785	.080	* .655	.705	.355	.305	.930	
	.265	.215	.745*	.795	.080	.665	.715	.345	.295	.930	Do Not Use (See Note #4)
0.	.255	.205	.755	.805	.080	.695	.725	.315	.275	.930	
0	.245	.195	.765	.815							
0	.235	.185	.775	.825							

$\Delta_C - \Delta_H = 0.050$ $\Delta_C - \Delta_H = .050$ $\Delta = 0.050$

TRAVEL	SPACER
.240 To .250	.930
.251 To .260	.955
.261 To .290	.975

OTE:
DESIRED RANGE OF COMPRESSED SPRING LENGTH (HOT & COLD TEMP) .725 MAX & .655 MIN
CHANGE OF FIRING PIN TRAVEL BETWEEN AMBIENT (70°F) TO HOT TEMP (160°F) = –.025 APPROX
" " " " " " " COLD " (20°F) = +.025 "
MIN TOTAL COMPRESSION (DEFLECTION) OF SPRING TO BE HELD TO .290
THIS COMBINATION OF PRESTRESS ON THE "FIRING PIN SPRING" & THE FIRING PIN TRAVEL WILL BE USED TO INSURE 100% FUNCTIONING OF THE .25 CAL. PRIMER. THE RESULTS IN THIS COMBINATION IS THE HIGH TRIGGER PULL AT COLD TEMP.

THIS FORM TO BE USED WITH C8650 WHEN TESTING IGNITOR ASSY

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REVISIONS

DO NOT SCALE DRAWING
ALL DIMENSIONS APPLY AFTER PLATING
125 FINISH ALL OVER EXCEPT WHERE NOTED
BREAK ALL SHARP CORNERS .005–.010
STANDARD TOLERANCES
DECIMAL ±.005
FRACTIONAL ±1/64
ANGULAR ±
ALL DIA. ON SAME ¢ TO BE CONCENTRIC WITHIN T.I.R.
UNLESS OTHERWISE NOTED

THIS PRINT SUPERSEDES ALL PRINTS PRIOR TO:

HESSE—EASTERN, DIVISION OF FLIGHTEX FABRICS, INC.
EVERETT 49, MASS.

IGNITION DATA (SEE NOTE #5)

BY	JR	5/19/60
CH'K'D	T.F.	5/19/60
ENG'R	T.F.	5/19/60
APP'D		

PROJ. | ASSY DWG
SCALE | REF DWG
MAT'L

B 8659 REV.

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